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APPLICATION FOR
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FOR

VERTICAL STAND-UP POUCH WITH ZIPPER SEAL QUICK CHANGE MODULE

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BACKGROUND OF THE INVENTION

1. Cross-Reference to Related Applications:

This application is a continuation-in-part of co-pending U.S. patent application Ser. No. 10/135,329, filed on April 30, 2002, which, in turn, is a continuation-in-part of co-pending U.S. Application No. 10/124,669 filed on April 17, 2002, and U.S. Application No. 10/100,370 filed on March 18, 2002.

2. Technical Field:

The present invention relates to a vertical stand-up pouch having vertical gussets and an integrated zipper seal constructed using a modified vertical form, fill, and seal packaging machine, and the method for making same, that provides for a single piece construction of a stand-up bag suitable for retail snack food distribution. The invention allows for use of existing film converter and packaging technology to produce a stand-up package having an integrated zipper seal with minimal increased costs and minimal modifications.

3. Description of the Related Art:

Vertical form, fill, and seal packaging machines are commonly used in the snack food industry for forming, filling, and sealing bags of chips and other like products. Such packaging machines take a packaging film from a sheet roll and forms the film into a vertical tube around a product delivery cylinder. The vertical tube is vertically sealed along its length to form a back seal. The machine applies a pair of heat-sealing jaws or

facings against the tube to form a horizontal transverse seal. This transverse seal acts as the top seal on the bag below and the bottom seal on the package being filled and formed above. The product to be packaged, such as potato chips, is dropped through the product delivery cylinder and formed tube and is held within the tube above the bottom transverse seal. After the package has been filled, the film tube is pushed downward to draw out another package length. A transverse seal is formed above the product, thus sealing it within the film tube and forming a package of product. The package below said transverse seal is separated from the rest of the film tube by cutting horizontally across the sealed area.

The packaging film used in such process is typically a composite polymer material produced by a film converter. For example, one prior art composite film used for packaging potato chips and like products is illustrated in **Figure 1**, which is a schematic of a cross-section of the film illustrating each individual substantive layer. **Figure 1** shows an inside, or product side, layer **16** which typically comprises metalized oriented polypropylene ("OPP") or metalized polyethylene terephtalate ("PET"). This is followed by a laminate layer **14**, typically a polyethylene extrusion, and an ink or graphics layer **12**. The ink layer **12** is typically used for the presentation of graphics that can be viewed through a transparent outside layer **10**, which layer **10** is typically OPP or PET.

The prior art film composition shown in **Figure 1** is ideally suited for use on vertical form and fill machines for the packaging of food products. The metalized inside

layer **16**, which is usually metalized with a thin layer of aluminum, provides excellent barrier properties. The use of OPP or PET for the outside layer **10** and the inside layer **16** further makes it possible to heat seal any surface of the film to any other surface in forming either the transverse seals or back seal of a package. Alternatively, a material can be used on the outside layer **12** that will not seal on itself, such as a paper layer or a non-sealing polymer layer, so that only the inside layer 16 is used as a sealing surface.

Typical back seals formed using the film composition shown in **Figure 1** are illustrated in **Figures 2a** and **2b**. **Figure 2a** is a schematic of a "lap seal" embodiment of a back seal being formed on a tube of film, which can be used when the outside and inside layers are sealable together. **Figure 2b** illustrates a "fin seal" embodiment of a back seal being formed on a tube of film, which can be used when the outside layer is not suitable as a sealing surface.

With reference to **Figure 2a**, a portion of the inside metalized layer **26** is mated with a portion of the outside layer **20** in the area indicated by the arrows to form a lap seal. The seal in this area is accomplished by applying heat and pressure to the film in such area. The lap seal design shown in **Figure 2a** insures that the product to be placed inside the formed package will be protected from the ink layer by the metalized inside layer **26**.

The fin seal variation shown in **Figure 2b** also provides that the product to be placed in the formed package will be protected from the ink layer by the metalized inside layer **26**. Again, the outside layer **20** does not contact any product. In the embodiment

shown in **Figure 2b**, however, the inside layer **26** is folded over and then sealed on itself in the area indicated by the arrows. Again, this seal is accomplished by the application of heat and pressure to the film in the area illustrated.

Regardless of whether a lap seal or fin seal is used for constructing a standard package using a vertical form, fill, and seal packaging machine, the end result is a package as shown in **Figure 3a** with horizontally oriented top and bottom transverse seals **31, 33**. Such package is referred to in the art as a "vertical flex bag" or "pillow pouch," and is commonly used for packaging snack foods such as potato chips, tortilla chips, and other various sheeted and extruded products. The back seal discussed with reference to **Figures 2a** and **2b** runs vertically along the bag and is typically centered on the back of the package shown in **Figure 3a**, thus not visible in **Figure 3a**. Because of the narrow, single edge base on the package shown in **Figure 3a** formed by the bottom transverse seal **33**, such prior art packages are not particularly stable when standing on one end. This shortcoming has been addressed in the packaging industry by the development of a horizontal stand-up pouch such as the embodiment illustrated in **Figures 4a**, **4b**, and **4c**. As can be seen by reference to said Figures, such horizontal stand-up pouch has a relatively broad and flat base **47** having two contact edges. This allows for the pouch to rest on this base **47** in a vertical presentation. Manufacture of such horizontal stand-up pouches, however, does not involve the use of standard vertical form, fill, and seal machines but, rather, involves an expensive and relatively slow 3-piece construction using a pouch form, fill, and seal machine.

Referring to **Figures 4b** and **4c**, the horizontal stand-up pouch of the prior art is constructed of three separate pieces of film that are mated together, namely, a front sheet **41**, a rear sheet **43**, and a base sheet **45**. The front sheet **41** and rear sheet **43** are sealed against each other around their edges, typically by heat sealing. The base sheet **45** is, however, first secured along its outer edges to the outer edges of the bottom of the front sheet **41** and rear sheet **43**, as is best illustrated in **Figure 4c**. Likewise, the mating of the base sheet **45** to the front sheet **41** and the rear sheet **43** is also accomplished typically by a heat seal. The requirement that such horizontal stand-up pouch be constructed of three pieces results in a package that is significantly more expensive to construct than a standard form, fill, and seal vertical flex bag.

Further disadvantages of using horizontal stand-up pouches include the initial capital expense of the horizontal stand-up pouch machines, the additional gas flush volume required during packaging as compared to a vertical flex bag, increased down time to change the bag size, slower bag forming speed, and a decreased bag size range. For example, a Polaris model vertical form, fill, and seal machine manufactured by Klick Lock Woodman of Georgia, USA, with a volume capacity of 60-100 bags per minute costs in the range of $75,000.00 per machine. A typical horizontal stand-up pouch manufacturing machine manufactured by Roberts Packaging of Battle Creek, Michigan, with a bag capacity of 40-60 bags per minute typically costs $500,000.00. The film cost for a standard vertical form, fill, and seal package is approximately $.04 per bag with a comparable horizontal stand-up pouch costing roughly twice as much. Horizontal stand-up pouches further require more than twice the oxygen or nitrogen gas flush. Changing

the bag size on a horizontal stand-up pouch further takes in excess of two hours, typically, while a vertical form and fill machine bag size can be changed in a matter of minutes. Also, the typical bag size range on a horizontal stand-up pouch machine is from 4 oz. to 10 oz., while a vertical form and fill machine can typically make bags in the size range of 1 oz. to 24 oz.

One current advantage of a horizontal stand-up pouch machine over a vertical form, fill, and seal machine, however, is the relatively simple additional step of adding a zipper seal at the top of the bag for reclosing of the bag. Vertical form, fill, and seal machines typically require substantial modification and/or the use of zipper seals premounted on the film oriented horizontally to the seal facings used to seal the horizontal transverse seals.

An alternative approach taken in the prior art to producing a bag with more of a stand-up presentation is the construction of a flat bottom bag such as illustrated in **Figure 3b**. Such bag is constructed in a method very similar to that described above with regard to prior art pillow pouches. However, in order to form the vertical gussets **37** on either side of the bag, the vertical form, fill, and seal machine must be substantially modified by the addition of two movable devices on opposite sides of the sealing carriage that moves in and out to make contact with the packaging film tube in order to form the tuck that becomes the gussets **37** shown in **Figure 3b**. Specifically, when a tube is pushed down to form the next bag, two triangular shaped devices are moved horizontally towards the packaging film tube until two vertical tucks are formed on the packaging film tube above

the transverse seals by virtue of contact with these moving triangular shaped devices. While the two triangular shaped devices are thus in contact with the packaging tube, the bottom transverse seal **33** is formed. The package is constructed with an outer layer **30** that is non-sealable, such as paper. This causes the formation of a V-shaped gusset **37** along each vertical edge of the package when the transverse seals **31**, **33** are formed. While the triangular shaped devices are still in contact with the tube of packaging material, the product is dropped through the forming tube into the tube of packaging film that is sealed at one end by virtue of the lower transverse seal **33**. The triangular shaped devices are then removed from contact with the tube of packaging film and the film is pushed down for the formation of the next package. The process is repeated such that the lower transverse seal **33** of the package above and upper transverse seal **31** of the package below are then formed. This transverse seal is then cut, thereby releasing a formed and filled package from the machine having the distinctive vertical gussets **37** shown in **Figure 3b**.

The prior art method described above forms a package with a relatively broad base due to the V-shaped vertical gussets **37**. Consequently, it is commonly referred to in the art as a flat bottom bag. Such flat bottom bag is advantageous over the previously described horizontal stand-up pouch in that it is formed on a vertical form, fill, and seal machine, albeit with major modifications. However, the prior art method of making a flat bottom bag has a number of significant drawbacks. For example, the capital expense for modifying the vertical form, fill, and seal machine to include the moving triangular-shaped devices is approximately $30,000.00 per machine. The changeover time to

convert a vertical form, fill, and seal machine from a standard pillow pouch configuration to a stand-up bag configuration can be substantial, and generally in the neighborhood of one-quarter man hours. The addition of all of the moving parts required for the triangular-shaped device to move in and out of position during each package formation cycle also adds complexity to the vertical form, fill, and seal machine, inevitably resulting in maintenance issues. Importantly, the vertical form, fill, and seal machine modified to include the moving triangular-shaped devices is significantly slower than a vertical form, fill, and seal machine without such devices because of these moving components that form the vertical gussets. For example, in the formation of a six inch by nine inch bag, the maximum run speed for a modified vertical form, fill, and seal machine using the triangular-shaped moving devices is in the range of 15 to 20 bags per minute. A standard vertical form, fill, and seal machine without such modification can construct a similarly sized pillow pouch at the rate of approximately 40 bags per minute.

Consequently, a need exists for a method to form a stand-up pouch, similar in appearance and functionality to the prior art horizontal stand-up pouches or prior art flat bottom bags, using vertical form, fill, and seal machine technology and a single sheet of packaging film. Moreover, a need also exists for a method of incorporating a zipper seal into such a formed stand-up pouch using the vertical form, fill, and seal machine technology. These methods should allow for reduced film cost per bag as compared to horizontal stand-up pouches, ease in size change, and little capital outlay, all while maintaining bag forming speeds typical of vertical form, fill, and seal machine pillow pouch production. Such methods should ideally produce a vertical stand-up pouch or a

flat bottom bag having a zipper seal incorporated therein, and constructed of materials commonly used to form standard vertical flex bags without adding complexity or moving parts to a standard vertical form, fill, and seal machine.

SUMMARY OF THE INVENTION

The proposed invention involves producing a vertical stand-up pouch or package having a zipper seal mechanism incorporated therein constructed of a single sheet of material using a vertical form, fill, and seal machine. The vertical form, fill, and seal machine may be specifically constructed to produce such a package or comprise a standard vertical form, fill, and seal machine which is slightly modified with a quick change module comprising a tension insertion mechanism in line with a longitudinal channel formed adjacent to the form/fill tube and a pair of forming plates located below the forming/filling tube and at least one stationary tucker mechanism mounted to the frame of the machine. The tucker mechanism is positioned between a pair of forming plates, thereby creating a vertical tuck along the length of the package while it is being formed.

Conversely, a length of zipper seal mechanism may be inserted and attached along a longitudinal length of the package on an opposing side from the side into which the vertical tuck is formed. The zipper seal mechanism is typically comprised of two interlocking and opposing members, each of which include a profile portion, which interlocks with a complementary profile portion on the other member, and a tab portion extending away from the profile portion.

The zipper seal mechanism is typically supplied from a supply spool, which feeds the zipper seal mechanism to a longitudinal channel formed in or adjacent to the forming/filling tube of the vertical form, fill, and seal machine. The length of zipper seal

mechanism may comprise either a continuous length of the zipper seal mechanism or separate segment lengths of zipper seal mechanism interspersed along an interconnecting webbing.

The length of zipper seal mechanism is attached to the packaging material while the material is being formed into a tubular shape. A reciprocating heat sealing mechanism attaches at least a portion of the tab portions of the each of the interlocked members comprising the zipper seal mechanism to an interior surface of the tubular shaped material prior to a longitudinal heat sealing mechanism applying a vertical back seal to the tubular shaped material.

A tension insertion mechanism located at the bottom of the forming/filling tube blouses the packaging film pushing the zipper seal mechanism into the interior of the package thereby creating a headspace between the film and the interlocked profiled portions of the zipper seal mechanism. The creation of the headspace improves the sealing qualities of the traverse sea subsequently applied to the package.

The graphics on the package are oriented 90° from a standard presentation when using the invention to make a vertical stand-up pouch. The transverse seals on such formed package are therefore oriented vertically when the bag is placed on display. Consequently, the vertical tuck is situated at the resulting package's base while the zipper seal mechanism is situated on the interior of the top of the resulting package.

The method disclosed and the package formed as a consequence is a substantial improvement over prior art horizontal stand-up pouches or packages. The method works

on existing vertical form, fill, and seal machines requiring very little modification. There are no substantial moving parts or jaw carriage modifications involved. The vertical form, fill, and seal machines can be easily converted back to a pillow pouch configuration with a simple module change. The same metalized or clear laminations used as materials in pillow pouches can also be used with the invention therefore saving in per bag cost.

The invention may also include a quick change module comprising the forming plates and, when making vertical stand-up pouches, a tension insertion mechanism on the opposite side of the forming tube from the crease forming plates. The module easily attaches to the bottom of the forming tube, thereby making conversion back to a standard pillow bag manufacture simple and quick.

The above as well as additional features and advantages of the present invention will become apparent in the following written detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will be best understood by reference to the following detailed description of illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

Figures 1 is a schematic cross-section views of prior art packaging films;

Figure 2a is a schematic cross-section view of a tube of packaging film illustrating the formation of a prior art lap seal;

Figure 2b is a schematic cross-section of a tube of packaging film illustrating the formation of a prior art fin seal;

Figure 3a is a perspective view of a prior art vertical flex bag;

Figure 3b is a perspective view of a prior art flat bottom bag;

Figures 4a, 4b, and 4c are perspective views in elevation of a prior art horizontal stand-up pouch;

Figure 5a is a schematic cross-section of a tube of packaging film formed by the vertical stand-up pouch embodiment of the present invention methods;

Figure 5b is a schematic cross-section of a tube of packaging film formed by the flat bottom bag embodiment of the present invention methods;

Figure 5c is a schematic cross-section of a tube of packaging film formed by the vertical stand-up pouch having a zipper seal incorporated therein embodiment of the present invention methods;

Figure 5d is an enlarged view of the top of the schematic cross-section of a tube of packaging film formed by the vertical stand-up pouch having a zipper seal incorporated therein shown in Figure 5c;

Figure 6a is a perspective view of the tucker mechanism, forming plates, and tension bar in elevation of the vertical stand-up pouch embodiment of the present invention in relation to a forming tube and sealing jaws of a vertical form, fill, and seal machine;

Figure 6b is a perspective view of the tucker mechanism and forming plates in elevation of the flat bottom bag embodiment of the present invention in relation to a forming tube and sealing jaws of a vertical form, fill, and seal machine;

Figure 6c is a perspective view of the tucker mechanism, forming plates, and zipper seal insertion mechanism in elevation of the vertical stand-up pouch having a zipper seal incorporated therein embodiment of the present invention in relation to a forming tube and sealing jaws of a vertical form, fill, and seal machine;

Figures 7a and 7b are perspective views of the vertical stand-up pouch of the present invention;

Figures 7c and 7d are perspective views of the vertical stand-up pouch having a zipper seal incorporated therein of the present invention;

Figure 8 is a perspective view of one embodiment of the tucker mechanism of the present invention;

Figure 9a is a perspective view of one embodiment of the quick change module of the present invention in elevation below the bottom of a forming tube;

Figure 9b is a sectional view of one embodiment of the quick change module attached to the bottom of a forming tube, said sectional view taken along lines **9b--9b** of **Figure 9a**; and

Figure 9c is a side view in elevation of one embodiment of the quick change module of the present invention.

Figure 10 is a cross-sectional view of one embodiment of interlocking zipper elements comprising a zipper seal mechanism utilized in the form, fill, and seal packaging machine of the present invention;

Figure 11 is a simplified perspective view of a form, fill, and seal packaging

machine adapted to manufacture a stand-up pouch having a zipper seal incorporated therein in accordance with the present invention;

Figure 12a is a simplified sectional view of a first embodiment of a zipper heat seal bar, said sectional view taken along lines 12–12 of Figure 11;

Figure 12b is a simplified sectional view of a second embodiment of a zipper heat seal bar, said sectional view taken along lines 12–12 of Figure 11;

Figure 13a is a perspective view of one embodiment of the zipper seal insert quick change module of the present invention in elevation below the bottom of a forming tube;

Figure 13b is a sectional view of one embodiment of the zipper seal insert quick change module attached to the bottom of a forming tube, said sectional view taken along lines 13b–13b of Figure 13a;

Figure 13c is a reverse perspective view of a transition tension mechanism in the embodiment of the zipper seal insert quick change module of the present invention shown in Figure 13a; and

Figure 13d is a simplified sectional view of the transition tension mechanism, said sectional view taken along lines 13d–13d of Figure 13c.

Where used in the various figures of the drawing, the same numerals designate the same or similar parts. Furthermore, when the terms "top," "bottom," "first," "second," "upper," "lower," "height," "width," "length," "end," "side," "horizontal," "vertical," and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawing and are utilized only to facilitate describing the invention.

All figures are drawn for ease of explanation of the basic teachings of the present invention only; the extensions of the figures with respect to number, position, relationship, and dimensions of the parts to form the preferred embodiment will be explained or will be within the skill of the art after the following teachings of the present invention have been read and understood. Further, the exact dimensions and dimensional

proportions to conform to specific force, weight, strength, and similar requirements will likewise be within the skill of the art after the following teachings of the present invention have been read and understood.

DETAILED DESCRIPTION OF THE INVENTION

A. Vertical Stand-Up Pouch

Figures 5a and 6a illustrate the basic components used with the method of the proposed invention as it relates to the manufacture of a vertical stand-up pouch. The same reference numbers are used to identify the same corresponding elements throughout all drawings unless otherwise noted. **Figure 5a** is a schematic cross-section of a tube of packaging material (film) formed by the present invention method. The tube of packaging film shown in **Figure 5a** is illustrated as a cross-sectional area immediately below the forming tube **101** of **Figure 6a**. The tube of packaging film comprises an outer layer **116** and an inner layer **110**, and can comprise material typically used in the field of art for making a standard vertical flex bag, such as discussed in relation to **Figure 1**. The tube in **Figure 5a** has been formed by sealing one sheet of film with a vertical back seal, as previously described with regard to discussions of prior art vertical form and fill machine methods.

Figure 6a shows a forming tube **101** typical in most respects to those used with prior art vertical form, fill, and seal machines. This forming tube **101** can be a cylinder, have a rectangular cross section, or any number of shapes, but is preferably cylindrical as illustrated. The film illustrated in **Figure 5a** is initially formed around the forming tube **101** of **Figure 6a**. This forming tube **101** is shown in elevation but would normally be integrally attached to the vertical form, fill, and seal machine. Also shown in **Figure 6a** are a pair of prior art sealing jaws **108** likewise illustrated in elevation. Not shown in

Figure 6a is the sealing jaw carriage on which such sealing jaws **108** would be mounted below the forming tube **101**.

As previously described, the practice in the prior art in the manufacture of a vertical flex bag involves feeding a continuous packaging film directed around the forming tube **101**. A back seal is formed on a single layer of film in order to create a tube of film around the forming tube **101**. The seal jaws **108** close on the thus formed tube of packaging film, thereby forming a bottom transverse seal. Product is then dropped through the forming tube **101** into the tube of packaging film. The tube is then driven downward by friction against rotating belts (not shown), and the seal jaws **108** are used to form another transverse seal above the level of the product found inside the tube. This seal is subsequently cut horizontally such that a top transverse seal is formed at the top of the filled bag below and a bottom transverse seal is formed on the tube of packaging film above. The packaging film during the prior art operation described above is oriented perpendicular to the longitudinal translation of the film so as to be readable by an operator of the machine as the film travels down the forming tube **101**. This orientation provides graphics **39** on the formed prior art bag that are readable by a consumer when the formed bag is placed on a retail display shelf while resting on its bottom transverse seal **33** as seen in **Figure 3a**. As will be described in further detail below, the orientation of the graphics on the film packaging for Applicants' invention is 90° off of the prior art orientation, such that the graphics appear sideways as viewed by the operator of the vertical form and fill machine as the film is pulled down the forming tube **101** of **Figure 6a**. In other words, the graphics on the packaging film are oriented perpendicular to the

direction of film travel.

The invention adds three basic components to a prior art vertical form, fill, and seal machine. Two forming plates **104** and one tension bar **102** are used to hold the packaging film tube in tension from inside the tube, as indicated by the arrows illustrated on **Figure 5a**. As shown in **Figure 6a**, the forming plates **104** and tension bar **102** can be attached directly to the forming tube **101** or, alternatively, to any supporting structure on the vertical form, fill, and seal machine, as long as the forming plates **104** and tension bar **102** are positioned within the tube of packaging material, below the bottom of the forming tube **101**, and above the heat sealing jaws **108**.

Tension is applied on the outside of the film and in the opposite direction of the tension provided by the forming plates **104** by a fixed or stationary tucker mechanism **106**, alternatively referred to herein as a tucker bar **106**, positioned between said forming plates **104**. The tucker bar **106** is preferably attached to the sealing carriage for the vertical form, fill, and seal machine and is adjustable along all three axes (in/out, up/down, and front/back). Alternatively, the tucker bar **106** can be attached to the frame of the vertical form, fill, and seal machine or any other point that can supports its function outside the film tube. These adjustments in all three axes allow for the tucker bar **106** to be easily moved out of the way to convert the vertical form and fill machine back to standard operation and is accomplished, in the embodiment shown in **Figure 6a**, by a tension screw **162** that can lock the tucker bar **106** in place when tightened. While the tucker bar **106** is adjustable, unlike in the prior art, it is fixed or stationary during

operation. Therefore, the present invention is a substantial improvement over the art in that there are no moving parts to the tucker mechanism during bag making. This improvement is what Applicants intend to describe when referring to the tucker bar **106** as "stationary" or "fixed." Because of this stationary tucker bar feature, bag making speeds can match typical pillow pouch manufacturing rates.

When moved forward into position (*i.e.*, toward the forming plates **104**), the tucker bar **106** provides a crease or fold in the tube of the packaging film between the two forming plates **104**. This crease is formed prior to formation of the transverse seal by the seal jaws **108**. Consequently, once the transverse seal is formed, the crease becomes an integral feature of one side of the package. The vertical form and fill machine thereafter operates basically as previously described in the prior art, with the sealing jaws **108** forming a lower transverse seal, product being introduced through the forming tube **101** into the sealed tube of packaging film (which now has a crease on one side), and the upper transverse seal being formed, thereby completing the package. The major differences between a prior art package and Applicants' package, however, are that a crease is formed on one side (which later becomes the bottom of the formed package) using the fixed mechanism described and that the graphics on the packaging film used by the invention are oriented such that when the formed package is stood onto the end with the crease, the graphics are readable by a consumer.

An example of the formed package of the instant invention is shown in **Figures 7a and 7b**, which show the outside layer of the packaging film **116** with the graphics **179**

oriented as previously described. As can be seen from **Figures 7a and 7b**, the construction of the invention's vertical stand-up pouch shares characteristics with the prior art vertical flex bags shown in **Figure 3a**. However, the transverse seals **131, 133** of the vertical stand-up bag of the invention are oriented vertically once the bag stands up on one end, as shown in **Figure 7b**. **Figure 7a** shows the crease **176** that was formed by the tucker bar **106** and forming plates **104** discussed in relation to **Figures 5a and 6a**.

Returning to **Figure 6a**, another optional feature that can be incorporated into this invention is the use of a diversion plate **160** within the forming tube **101**. This diversion plate **160**, in the embodiment illustrated, is a flat plate welded vertically inside the forming tube **101** that extends from the bottom of the forming tube **101** to some distance above (for example, at least two or three inches) the bottom of the forming tube **101**, where it then is sealed against the inside of the forming tube **101**.

The diversion plate **160** in a preferred embodiment accomplishes two functions. First, the diversion plate **160** keeps product that is dropped down the forming tube **101** away from the area where the crease is being formed on the tube of packaging film. Second, the diversion plate **160**, can be used as a channel for a gas or nitrogen flush. In such instance, the diversion plate **160** at some point above the bottom of the forming tube **101** seals at the top of the plate **160** against the forming tube **101**. Below such seal (not shown) an orifice can be drilled into the forming tube **101** in order to provide gas communication between an exterior gas (for example, nitrogen or oxygen) source and the cavity formed between the diversion plate **160** and the interior of the forming tube **101**.

The diversion plate **160** as shown in **Figure 6a** is a flat plate, but it should be understood that it can be of any variety of shapes, for example, having a curved surface, provided that it accomplishes the functionality of diverting the product away from the area where the tuck is formed on the tube of film.

By using the diversion plate **160** as a channel for the gas flush, the present invention eliminates the need for a separate gas tube to be placed inside the forming tube **101** that normally accomplishes the same function in the prior art. The added benefit of providing a relatively large volume channel formed by the diversion plate **160** and the interior of the forming tube **101** is that a relatively large volume of flushing gas can be introduced into a filled and partially formed package at a significantly lower gas velocity compared to prior art gas tubes. This allows for the filling of packages using this embodiment of the present invention that may contain low weight product that might otherwise be blown back into the forming tube by prior art flushing tubes.

Figure 8 illustrates a preferred embodiment of the tucker bar **106**. This embodiment of the tucker bar **106** comprises a head **180** attached to a support **182**. Drilled within the support **182** and head **180** is a gas channel **184** shown in phantom on **Figure 8**. This gas channel **184** provides a gas communication from an exterior gas source (not shown) through the support **182**, through the head **180**, and out three orifices **186**. The gas channel **184** allows for a metered burst of pressurized gas (typically air) that helps keep the tuck illustrated in **Figure 5a** taut throughout the forming and sealing operation without the necessity of moving the tucker bar in and out during bag formation. It should

be noted that during operation (bag making) the tucker bar **106** is always stationary. It should further be noted that the head **180** necessarily cannot extend along the entire length of the crease formed by the tucker bar **106** and forming plates **104**. Further, it should be understood that when the sealing jaws **108** close onto the tube of film, the lateral dimensions of the tube of film change. All of these facts are compensated for by the use of the pressurized air bursting from the orifices **186**. The pressurized air keeps an even amount of pressure on the tuck as it is being formed in the various stages of the forming and sealing process. The air burst can be continuous, but is preferably metered to start as the film for the next bag is being pulled down through the completion of the transverse seal.

The head **180** can comprise any non-stick material but is preferably a fluoropolymer, such as Teflon®. In an alternative embodiment, the tucker bar **106** can comprise one integral piece of metal with the head portion **180** being coated with a fluoropolymer. The curved contact area of the head **180** allows for the continuous formation of the tuck illustrated in **Figure 5a** without tearing the packaging film as it is pushed down below the forming tube. While shown with three orifices **186**, the head **180** can comprise any number of orifices from one on.

To further compensate for the change in the width of the film tube as the transverse seal is formed by the seal jaws **108** of **Figure 6a**, it should be noted that the tension bar **102** bends outwardly away from the center of said tube of film along the length of the tension bar **102** and the forming plates **104** are hinged by a horizontal hinge

165. If the tension bar **102** is designed otherwise (*e.g.*, strictly vertical) excess slack occurs in the area of the film tube near the transverse seal. The forming plates **104** comprise horizontal hinges **165** that allow the forming plates to fold inward (*i.e.*, toward each other) slightly while the lower transverse seal is formed. Otherwise, the tube of packaging film would be ripped by the tips of the forming plates **104** during this step.

The present invention offers an economic method of producing a stand-up pouch with numerous advantages over prior art horizontal stand-up pouches and methods for making them.

Examples of these advantages are illustrated in Table 1 below.

TABLE 1	Current Vertical Flex Bag	Commercially Available Horizontal Stand-Up Pouches	Applicants' Vertical Stand-Up Bag
Machine Type	Standard Vertical FFS	Pouch Form, Fill, Seal	Standard Vertical FFS
Machine Cost	$75,000.00	$500,000.00	$75,000.00
Film Cost	$0.04/bag	$0.08/bag	$0.04/bag
Gas Flush	Less than 2% O_2	Only to 5% O_2	Less than 2% O_2
Size Change	Easy, change former	2 hours	Easy, change former
Format Change	Flex Bag Only	Stand-Up Pouch Only	Both, simple change
Continuous Feed Zipper Option	No	Yes	Yes
Bag Size Range in Inches	(Width/Height) 5/5 through 14/24	(Width/Height) 5/5 through 10/12	(Width/Height) 5/5 through 24/11

As noted above and will be described in further detail below, a continuous feed zipper option is available on Applicants' invention, which is not available using current vertical form, fill, and seal machine technology. This is because of the orientation of the film graphics used on the packaging film of the present invention. Since the graphics are

oriented 90° from the prior art, a zipper seal can be run continuously in a vertical line down the forming tube along with the packaging film as it is being formed into a tube and subsequent package. This is not possible with the prior art, because such orientation of a continuous vertical strip of a zipper seal would place such seal in a vertical orientation once the package is formed and stood up for display.

The invention is further an improvement over methods for manufacturing prior art flat bottom bags. Since the tucker mechanism of Applicants' invention is stationary during bag formation, the present invention eliminates the need for moving parts that push against the film tube for the formation of a gusset. This elimination of moving parts allows for increased bag production rates, significantly lower changeover times to pillow pouch production, and significantly fewer maintenance issues.

B. Flat Bottom Bag

Figures 5b and 6b illustrate the basic components used with the method of the proposed invention as it relates to the manufacture of a flat bottom bag. **Figure 5b** is a schematic cross-section of a tube of packaging material (film) formed by the present invention method. The tube of packaging film shown in **Figure 5b** is illustrated as a cross-sectional area immediately below the forming tube **101** of **Figure 6b** (shown in phantom in **Figure 5b**). The tube of packaging film comprises an outer layer **116** and an inner layer **110**, and can comprise material typically used in the field of art for making a standard vertical flex bag, such as discussed in relation to **Figure 1**. However, for reasons that will become apparent from the discussion below, a preferred embodiment of

the bag of the present invention comprises an outside layer **116** that is not sealable on itself, such as paper. The tube in **Figure 5b** has been formed by sealing one sheet of film with a vertical back seal, as previously described with regard to discussions of prior art vertical form and fill machine methods.

Figure 6b shows a forming tube **101** typical in most respects to those used with prior art vertical form, fill, and seal machines. This forming tube **101** can be a cylinder, have a rectangular cross section, or any number of shapes, but is preferably cylindrical as illustrated. The film illustrated in **Figure 5b** is initially formed around the forming tube **101** of **Figure 6b**. This forming tube **101** is shown in elevation but would normally be integrally attached to the vertical form, fill, and seal machine. Also shown in **Figure 6b** are a pair of prior art sealing jaws **108** likewise illustrated in elevation. Not shown in **Figure 6b** is the sealing jaw carriage on which such sealing jaws **108** would be mounted below the forming tube **101**.

As previously described, the practice in the prior art in the manufacture of a vertical flex bag involves feeding a continuous packaging film directed around the forming tube **101**. A back seal is formed on a single layer of film in order to create a tube of film around the forming tube **101**. The seal jaws **108** close on the thus formed tube of packaging film, thereby forming a bottom transverse seal. Product is then dropped through the forming tube **101** into the tube of packaging film. The tube is then driven downward by friction against rotating belts (not shown) and the seal jaws **108** are used to form another transverse seal above the level of the product found inside the tube. This

seal is subsequently cut horizontally such that a top transverse seal is formed at the top of the filled bag below and a bottom transverse seal is formed on the tube of packaging film above. The packaging film during the prior art operation described above is oriented perpendicular to the longitudinal translation of the film so as to be readable by an operator of the machine as the film travels down the forming tube **101**. This orientation provides graphics **39** on the formed prior art bag that are readable by a consumer when the formed bag is placed on a retail display shelf while resting on its bottom transverse seal **33** as seen in **Figure 3a**.

The invention adds two basic components to a prior art vertical form, fill, and seal machine. Two pair of stationary or fixed forming plates **104, 105** are used to hold the packaging film tube in tension from inside the tube, as indicated by the arrows illustrated on **Figure 5b**. As shown in **Figure 6b**, the forming plates **104, 105** can be attached directly to the forming tube **101** or, alternatively, to any supporting structure on the vertical form, fill, and seal machine, as long as the forming plates **104, 105** are positioned within the tube of packaging material, below the bottom of the forming tube **101**, and above the heat sealing jaws **108**.

Tension is applied on the outside of the film and in the opposite direction of the tension provided by the forming plates **104, 105** by two stationary or fixed tucker mechanisms **106, 107**, alternatively referred to herein as tucker bars **106, 107**, positioned between said forming plates **104, 105**. The tucker bars **106, 107** are preferably attached to the sealing carriage for the vertical form, fill, and seal machine and are adjustable along

all three axes (in/out, up/down, and front/back). Alternatively, the tucker bars **106, 107** can be attached to the frame of the vertical form, fill, and seal machine or any other point that can supports their function outside the film tube. These adjustments in all three axes allow for the tucker bars **106, 107** to be easily moved out of the way to convert the vertical form and fill machine back to standard operation and is accomplished, in the embodiment shown in **Figure 6b**, by a tension screw **162** that can lock the tucker bars **106, 107** in place when tightened. While the tucker bars **106, 107** are adjustable, unlike in the prior art, they are fixed or stationary during operation. Therefore, the present invention is a substantial improvement over the art in that there are no moving parts to the tucker mechanism during bag making. This improvement is what Applicants intend to describe when referring to the tucker bars **106, 107** as "stationary" or "fixed." Because of this stationary tucker bar feature, bag making speeds can match typical pillow pouch manufacturing rates, modification costs are low (such as 3 to 4 thousand dollars per machine), and no additional maintenance issues are introduced.

When moved forward into position (*i.e.*, toward the forming plates **104, 105**), the tucker bars **106, 107** provide a crease or fold in the tube of the packaging film between the two forming plates **104, 105**. This crease is formed prior to formation of the transverse seal by the seal jaws **108**. Consequently, once the transverse seal is formed, the crease becomes an integral feature of two sides of the package, referred to as gussets. As shown in **Figure 3b**, these gussets **37** form a "V" shape on each end of the horizontal transverse seals **31, 33** because the outer layer of packaging film used to form the bag comprises a material that does not seal on itself, such as paper. In an alternative embodiment, the

outside layer **30** of the film comprises a material that seals on itself, thereby closing the ends of the "V" shaped gussets illustrated in **Figure 3b**.

After the transverse seals are formed, the vertical form and fill machine thereafter operates basically as previously described in the prior art, with the sealing jaws **108** forming a lower transverse seal, product being introduced through the forming tube **101** into the sealed tube of packaging film (which now has a vertical crease on two opposite sides), and the upper transverse seal being formed, thereby completing the package. A major difference between a prior art package and Applicants' package, however, is that a gusset is formed on each side of the package of the present invention using the fixed mechanism described.

An example of the formed package of the instant invention is shown in **Figure 3b**, which shows the outside layer of the packaging film **30** with the graphics **38** oriented as previously described. As can be seen from **Figure 3b**, the construction of the invention's flat bottom bag shares characteristics with the prior art vertical flex bags shown in **Figure 3a**. **Figure 3b** shows the gussets **37** that were formed by the tucker bars **106, 107** and forming plates **104, 105** discussed in relation to **Figures 5b and 6b**.

Returning to **Figure 6b**, another optional feature that can be incorporated into this invention is the use of one or two diversion plates **160** within the forming tube **101**. These diversion plates **160**, in the embodiment illustrated, comprise a flat plate welded vertically inside the forming tube **101** that extends from the bottom of the forming tube **101** to some distance above (for example, at least two or three inches) the bottom of the

forming tube **101**, where it then is sealed against the inside of the forming tube **101**.

The diversion plates **160** in a preferred embodiment accomplish two functions. First, the diversion plates **160** keeps product that is dropped down the forming tube **101** away from the area where the crease is being formed on the tube of packaging film. Second, the diversion plates **160**, if properly sealed against the forming tube **101**, can be used as channels for a gas or nitrogen flush. In such instance, at least one, but preferably both diversion plates **160** at some point above the bottom of the forming tube **101** seal at the top of the plate **160** against the forming tube **101**. Below such seal (not shown) one or more orifices can be drilled into the forming tube **101** in order to provide gas communication between an exterior gas (for example, nitrogen or oxygen) source and the cavity formed between a diversion plate **160** and the interior of the forming tube **101**. The diversion plates **160** are shown in **Figure 6b** as a flat plate, but it should be understood that they could be of any variety of shapes, for example, having a curved surface, provided that they accomplish the functionality of diverting the product away from the area where the tucks are formed on the tube of film.

By using one or more of the diversion plates **160** as a channel for the gas flush, the present invention eliminates the need for a separate gas tube to be placed inside the forming tube **101** that normally accomplishes the same function in the prior art. The added benefit of providing a relatively large volume channel formed by a diversion plate **160** and the interior of the forming tube **101** is that a relatively large volume of flushing gas can be introduced into a filled and partially formed package at a significantly lower

gas velocity compared to prior art gas tubes. This allows for the filling of packages using this embodiment of the present invention that may contain low weight product that might otherwise be blown back into the forming tube by prior art flushing tubes.

Figure 8 illustrates a preferred embodiment of a tucker bar **106**. This embodiment of a tucker bar **106** comprises a head **180** attached to a support **182**. Drilled within the support **182** and head **180** is a gas channel **184** shown in phantom on **Figure 8**. This gas channel **184** provides a gas communication from an exterior gas source (not shown) through the support **182**, the head **180**, and out three orifices **186**. The gas channel **184** allows for a metered burst of pressurized gas (typically air) that helps keep the tuck illustrated in **Figure 5b** taut throughout the forming and sealing operation without the necessity of moving the tucker bar in and out during bag formation. It should be noted that during operation (bag making) the tucker bar **106** is always stationary. It should further be noted that the head **180** necessarily cannot extend along the entire length of the crease formed by the tucker bar **106** and forming plates **104**. Further, it should be understood that when the sealing jaws **108** close onto the tube of film, the lateral dimensions of the tube of film change. All of these facts are compensated for by the use of the pressurized air bursting from the orifices **186**. The pressurized air keeps an even amount of pressure on the tuck as it is being formed in the various stages of the forming and sealing process. The air burst can be continuous, but is preferably metered to start as the film for the next bag is being pulled down through the completion of the transverse seal.

The head **180** can comprise any non-stick material but is preferably a fluoropolymer, such as Teflon®. In an alternative embodiment, the tucker bar **106** can comprise one integral piece of metal with the head portion **180** being coated with a fluoropolymer. The curved contact area of the head **180** allows for the continuous formation of the tuck illustrated in **Figure 5b** without tearing the packaging film as it is pushed down below the forming tube. While shown with three orifices **186**, the head **180** can comprise any number of orifices from one on.

To further compensate for the change in the width of the film tube as the transverse seal is formed by the seal jaws **108** of **Figure 6b**, it should be noted that the forming plates **104, 105** are hinged by a horizontal hinge **165**. The forming plates **104, 105** comprise horizontal hinges **165** that allow the forming plates to fold inward (*i.e.*, toward each other) slightly while the lower transverse seal is formed. Otherwise, the tube of packaging film would be ripped by the tips of the forming plates **104, 105** during this step.

The present invention offers an economic method of producing a flat bottom bag with numerous advantages over prior art horizontal stand-up pouches and methods for making them.

Examples of these advantages are illustrated in Table 2 below.

TABLE 2	Current Vertical Flex Bag	Commercially Available Horizontal Stand-Up Pouches	Applicants' Flat Bottom Bag
Machine Type	Standard Vertical FFS	Pouch Form, Fill, Seal	Standard Vertical FFS
Machine Cost	$75,000.00	$500,000.00	$75,000.00
Film Cost	$0.04/bag	$0.08/bag	$0.04/bag
Gas Flush	Less than 2% O_2	Only to 5% O_2	Less than 2% O_2
Size Change	Easy, change former	2 hours	Easy, change former
Format Change	Flex Bag Only	Stand-Up Pouch Only	Both, simple change
Bag Size Range in Inches	(Width/Height) 5/5 through 14/24	(Width/Height) 5/5 through 10/12	(Width/Height) 5/5 through 11/24

Further, the speed at which a form, fill, and seal machine modified by Applicants' invention can run is not compromised by the modification, as is the case with the prior art method for making a flat bottom bag using a triangular-shaped device that is moved in and out during operation. In fact, Applicants' invention allows bag production rates on the order of twice as fast as the prior art method for making the same style bag.

In addition, the lack of moving parts associated with the tucker mechanism of Applicants' invention greatly reduces the cost of converting a vertical form, fill, and seal machine to manufacturing flat bottom bags, as well as reduces maintenance issues involved thereby. For example, converting a vertical form, fill, and seal machine to a flat bottom bag configuration using prior art devices that move in and out during operation costs in the range of $30,000.00 per machine. Applicants' invention involves retrofitting existing vertical form, fill, and seal machines at a fraction, approximately 1/10th, of that cost.

C. Zipper Seal Insertion Mechanism

Another embodiment of the invention further includes an apparatus and method for producing a stand-up package having a zipper seal incorporated therein. **Figures 5c and 6c** illustrate the basic components used with the method of the proposed invention as it relates to the manufacture of a stand-up package having a zipper seal incorporated therein. The same reference numbers are used to identify the same corresponding elements throughout all drawings unless otherwise noted. **Figure 5c** is a schematic cross-section of a tube of packaging material (film) formed by the present invention method. The tube of packaging film shown in **Figure 5c** is illustrated as a cross-sectional area immediately below the forming tube **101** of **Figure 6c**. The tube of packaging film comprises an outer layer **116** and an inner layer **110**, and can comprise material typically used in the field of art for making a standard vertical flex bag, such as discussed in relation to **Figure 1**. The tube in **Figure 5c** has been formed by sealing one sheet of film with a vertical back seal, as previously described with regard to discussions of prior art vertical form and fill machine methods.

Figure 6c shows a forming tube **101** typical in most respects to those used with prior art vertical form, fill, and seal machines. This forming tube **101** can be a cylinder, have a rectangular cross section, or any number of shapes. This forming tube **101** includes a channel track **188** formed along one side for receiving a length of zipper seal mechanism **220**. The zipper seal mechanism **220** is typically supplied from a supply spool **218**, which feeds the zipper seal mechanism **220** to the longitudinal channel **188** formed in

or adjacent to the forming tube **101** of the vertical form, fill, and seal machine.

The length of zipper seal mechanism **220** may comprise either a continuous length of zipper seal mechanism **220** or separate segments of zipper seal mechanism **220** interspersed along an interconnecting webbing. As shown in **Figure 10**, the length of zipper seal mechanism **220** is comprised of two opposing and interlocking zipper elements or members **222**, **226**. Each of the zipper members **222**, **226** include a tab portion and an interlocking profile portion. For example, a first zipper element **222** includes a tab portion **223** and a male interlocking profile portion **224**; while the second zipper element **226** includes a tab portion **227** and a female interlocking profile portion **228**.

The packaging film illustrated in **Figure 5c** is initially formed around the forming tube **101** of **Figure 6c**. However, prior to sealing the one sheet of film with a vertical back seal, at least a portion of the zipper seal mechanism **220** is sealed to the surface of the packaging film which will subsequently comprise the inner layer **110** of the tube. This forming tube **101** is shown in elevation but would normally be integrally attached to the vertical form, fill, and seal machine. Also shown in **Figure 6c** are a pair of prior art sealing jaws **108** likewise illustrated in elevation. Not shown in **Figure 6c** is the sealing jaw carriage on which such sealing jaws **108** would be mounted below the forming tube **101**.

As previously described, the practice in the prior art in the manufacture of a vertical flex bag involves feeding a continuous packaging film directed around the forming tube **101**. A back seal is formed on a single layer of film in order to create a tube

of film around the forming tube **101**. The seal jaws **108** close on the thus formed tube of packaging film, thereby forming a bottom transverse seal. Product is then dropped through the forming tube **101** into the tube of packaging film. The tube is then driven downward by friction against rotating belts (not shown), and the seal jaws **108** are used to form another transverse seal above the level of the product found inside the tube. This seal is subsequently cut horizontally such that a top transverse seal is formed at the top of the filled bag below and a bottom transverse seal is formed on the tube of packaging film above. The packaging film during the prior art operation described above is oriented perpendicular to the longitudinal translation of the film so as to be readable by an operator of the machine as the film travels down the forming tube **101**. This orientation provides graphics **39** on the formed prior art bag that are readable by a consumer when the formed bag is placed on a retail display shelf while resting on its bottom transverse seal **33** as seen in **Figure 3a**. As described in the previous embodiments of the invention, the orientation of the graphics on the film packaging for Applicants' present invention is 90° off of the prior art orientation, such that the graphics appear sideways as viewed by the operator of the vertical form, fill, and seal machine as the film is pulled down the forming tube **101** of **Figure 6c**.

The present invention adds several basic components to a prior art vertical form, fill, and seal machine. Two forming plates **104** and a tension insertion mechanism **202** are used to hold the packaging film tube in tension from inside the tube, as indicated by the arrows illustrated on **Figure 5c**. As shown in **Figure 6c**, the forming plates **104** and tension insertion mechanism **202** can be attached directly to the forming tube **101** or,

alternatively, to any supporting structure on the vertical form, fill, and seal machine, as long as the forming plates **104** and the tension insertion mechanism **202** are positioned within the tube of packaging material, below the bottom of the forming tube **101**, and above the heat sealing jaws **108**.

Tension is applied on the outside of the film and in the opposite direction of the tension provided by the forming plates **104** by a fixed or stationary tucker mechanism **106**, alternatively referred to herein as a tucker bar **106**, positioned between said forming plates **104**. The tucker bar **106** is preferably attached to the sealing carriage for the vertical form, fill, and seal machine and is adjustable along all three axes (in/out, up/down, and front/back). Alternatively, the tucker bar **106** can be attached to the frame of the vertical form, fill, and seal machine or any other point that can supports its function outside the film tube. These adjustments in all three axes allow for the tucker bar **106** to be easily moved out of the way to convert the vertical form and fill machine back to standard operation and is accomplished, in the embodiment shown in **Figure 6c**, by a tension screw **162** that can lock the tucker bar **106** in place when tightened. While the tucker bar **106** is adjustable, unlike in the prior art, it is fixed or stationary during operation. Therefore, the present invention is a substantial improvement over the art in that there are no moving parts to the tucker mechanism during bag making. This improvement is what Applicants intend to describe when referring to the tucker bar **106** as "stationary" or "fixed." Because of this stationary tucker bar feature, bag making speeds can match typical pillow pouch manufacturing rates.

When moved forward into position (*i.e.*, toward the forming plates **104**), the tucker bar **106** provides a crease or fold in the tube of the packaging film between the two forming plates **104**. This crease is formed prior to formation of the transverse seal by the seal jaws **108**. Consequently, once the transverse seal is formed, the crease becomes an integral feature of one side of the package.

The present invention further includes a channel track **188** formed along one side of the forming tube **101** and adapted for receiving a length of zipper seal mechanism **220** from a supply spool **218**. As will be subsequently explained, the channel track **188** may either be formed or fashioned into the sidewall of the forming tube **191** or comprise a longitudinal gap between two heat seal plates attached to the sidewall of the forming tube **191**. Regardless of the embodiment selected, the channel track **188** performs two critical functions. First, the channel track **188** effectively controls the positioning of the zipper seal mechanism **220** along the inner layer **110** of the tube. Second, the channel track **188** protects the interlocked profile portions **224**, **228** of the zipper seal mechanism **220** from fusing together when the tab portions **223, 227** are heat sealed to the inner layer **110** of the formed tube.

Thus, in accordance with the present invention, a length of zipper seal mechanism **220** is directed to the top portion of the forming tube **101** such that the two interlocked zipper members **222**, **226** are together threaded down the channel track **188** formed along one side of the forming tube **101**. The associated tab portions **223**, **227** of zipper seal mechanism **220** are splayed out along the outer peripheral surface of the forming tube **101**

so as not to overlap one another. Packaging film is initially formed around the forming tube **101** in a conventional manner. However, prior to sealing the one sheet of film with a vertical back seal, at least a portion of each of the tab portions **223, 227** of the zipper seal mechanism **220** is sealed to the surface of the packaging film which will subsequently comprise the inner layer **110** of the tube. Thus, as the formed tube is advanced down the forming tube **101** in a conventional manner, the length of zipper mechanism **220** that is sealed on the interior of the formed tube is also advanced.

Referring now **Figures 5c**, **5d** and **6c**, at the bottom of the forming tube **101**, the channel track **188** extends through the tension insertion mechanism **202** such that as tension is applied to the advancing formed tube, the associated tab portions **223, 227** of the zipper seal mechanism **220** are projected away from the surface of the forming tube **101** and bent around two projecting plates **192a, 192b** of the tension insertion mechanism **202** thereby blousing the packaging film between the two portions of the associated tab portions **223, 227** sealed to the inner layer **110** of the formed tube. This blousing creates a headspace **201** between the film and the interlocked profile portions **224, 228** of the zipper seal mechanism **220**. The creation of the headspace **201** improves the sealing qualities of the traverse seal subsequently applied to the package.

The vertical form, fill, and seal machine of the present invention thereafter operates basically as previously described in the prior art, with the sealing jaws **108** forming a lower transverse seal, product being introduced through the forming tube **101** into the sealed tube of packaging film (which now has a crease on one side and a zipper

seal on another side), and the upper transverse seal being formed, thereby completing the package.

The major differences between a prior art package and this embodiment of Applicants' package, however, are that a crease is formed on one side (which later becomes the bottom of the formed package) using the fixed mechanism described, a length zipper seal mechanism **220** in sealed onto the inner layer **110** of another side (which later becomes the top of the formed package) using the channel track **188** and the fixed tension insertion mechanism **202** described, and that the graphics on the packaging film used by the invention are oriented such that when the formed package is stood onto its end with the creased end generally at the bottom and the zipper seal end generally at the top, the graphics are readable by a consumer.

An example of the formed package of the instant invention is shown in **Figures 7c** and **7d**, which show the outside layer of the packaging film **116** with the graphics **179** oriented as previously described. As can be seen from **Figures 7c** and **7d**, the construction of the invention's vertical stand-up pouch shares characteristics with the prior art vertical flex bags shown in **Figure 3a**. However, the transverse seals **131, 133** of the vertical stand-up bag of the invention are oriented vertically and the vertical back seal **251** is oriented horizontally once the bag stands up on one end, as shown in **Figure 7d**. **Figure 7c** shows the crease **176** that is formed by the tucker bar **106** and forming plates **104** and the zipper seal mechanism **220** positioned and sealed on the package interior as previously discussed in relation to **Figures 5c** and **6c**.

As noted previously, the added ability to insert a zipper seal mechanism **220** enabled by Applicants' invention, is not available using current vertical form, fill, and seal machine technology. This is due, in part, to the orientation of the film graphics used on the packaging film of the present invention. Since the graphics are oriented 90° from the prior art, a zipper seal mechanism **220** can be run longitudinally along the forming tube adjacent with the packaging film as it is being formed into a tube. This is not possible with the prior art because such an orientation of a vertical length of a zipper seal would place such seal in a vertical orientation once the package is formed and stood up for display.

Returning to **Figure 6c**, another optional feature that can be incorporated into this invention is the use of a diversion plate **160** within the forming tube **101**. This diversion plate **160**, in the embodiment illustrated, is a flat plate welded vertically inside the forming tube **101** that extends from the bottom of the forming tube **101** to some distance above (for example, at least two or three inches) the bottom of the forming tube **101**, where it then is sealed against the inside of the forming tube **101**.

The diversion plate **160** in a preferred embodiment accomplishes two functions. First, the diversion plate **160** keeps product that is dropped down the forming tube **101** away from the area where the crease is being formed on the tube of packaging film. Second, the diversion plate **160**, can be used as a channel for a gas or nitrogen flush. In such instance, the diversion plate **160** at some point above the bottom of the forming tube **101** seals at the top of the plate **160** against the forming tube **101**. Below such seal (not

shown) an orifice can be drilled into the forming tube **101** in order to provide gas communication between an exterior gas (*e.g.*, nitrogen or oxygen) source and the cavity formed between the diversion plate **160** and the interior of the forming tube **101**. The diversion plate **160** as shown in **Figure 6c** is a flat plate, but it should be understood that it can be of any variety of shapes, for example, having a curved surface, provided that it accomplishes the functionality of diverting the product away from the area where the tuck is formed on the tube of film.

By using the diversion plate **160** as a channel for the gas flush, the present invention eliminates the need for a separate gas tube to be placed inside the forming tube **101** that normally accomplishes the same function in the prior art. The added benefit of providing a relatively large volume channel formed by the diversion plate **160** and the interior of the forming tube **101** is that a relatively large volume of flushing gas can be introduced into a filled and partially formed package at a significantly lower gas velocity compared to prior art gas tubes. This allows for the filling of packages using this embodiment of the present invention that may contain low weight product that might otherwise be blown back into the forming tube by prior art flushing tubes.

Figure 8 illustrates a preferred embodiment of the tucker bar **106**. This embodiment of the tucker bar **106** comprises a head **180** attached to a support **182**. Drilled within the support **182** and head **180** is a gas channel **184** shown in phantom on **Figure 8**. This gas channel **1°4** provides a gas communication from an exterior gas source (not shown) through the support **182**, through the head **180**, and out three orifices **186**. The gas

channel **184** allows for a metered burst of pressurized gas (typically air) that helps keep the tuck illustrated in **Figure 5c** taut throughout the forming and sealing operation without the necessity of moving the tucker bar in and out during bag formation. It should be noted that during operation (bag making) the tucker bar **106** is always stationary. It should further be noted that the head **180** necessarily cannot extend along the entire length of the crease formed by the tucker bar **106** and forming plates **104**. Further, it should be understood that when the sealing jaws **108** close onto the tube of film, the lateral dimensions of the tube of film change. All of these facts are compensated for by the use of the pressurized air bursting from the orifices **186**. The pressurized air keeps an even amount of pressure on the tuck as it is being formed in the various stages of the forming and sealing process. The air burst can be continuous, but is preferably metered to start as the film for the next bag is being pulled down through the completion of the transverse seal.

The head **180** can comprise any non-stick material but is preferably a fluoropolymer, such as Teflon®. In an alternative embodiment, the tucker bar **106** can comprise one integral piece of metal with the head portion **180** being coated with a fluoropolymer. The curved contact area of the head **180** allows for the continuous formation of the tuck illustrated in **Figure 5c** without tearing the packaging film as it is pushed down below the forming tube. While shown with three orifices **186**, the head **180** can comprise any number of orifices from one on.

To further compensate for the change in the width of the film tube as the

transverse seal is formed by the seal jaws **108** of **Figure 6c**, it should be noted that the two projecting plates **192a**, **192b** of the tension insertion mechanism **202** project outwardly away from the center of said tube of film along the length of the tension insertion mechanism **202** and the forming plates **104** may be hinged by a horizontal hinge **165**. If the tension insertion mechanism **202** is designed otherwise (*e.g.*, strictly vertical) excess slack occurs in the area of the film tube near the transverse seal. The forming plates **104** may include horizontal hinges **165** that allow the forming plates to fold inward (*i.e.*, toward each other) slightly while the lower transverse seal is formed. Otherwise, the tube of packaging film would be ripped by the tips of the forming plates **104** during this step.

As noted with previously described embodiments, the instant invention is further an improvement over methods for manufacturing prior art flat bottom bags. Since the tucker mechanism of Applicants' invention is stationary during bag formation, the present invention eliminates the need for moving parts that push against the film tube for the formation of a gusset. This elimination of moving parts allows for increased bag production rates, significantly lower changeover times to pillow pouch production, and significantly fewer maintenance issues.

D. Quick Change Module

Whether the vertical stand-up pouch embodiment or the flat bottom bag embodiment of the present invention is used, another embodiment of the invention incorporates a quick change module that can be installed on the bottom of a forming tube

in order to quickly modify a vertical form, fill, and seal machine from pillow pouch production to the desired stand-up bag production of the present invention. One embodiment of this quick change module, as it relates particularly vertical stand-up pouches, is illustrated by **Figures 9a**, **9b**, and **9c**. **Figure 9a** is a perspective view in elevation of the quick change module **94** suspended below the bottom of a forming tube **91** shown partially cut away in order to illustrate interior features. **Figure 9b** is a sectional view of the same embodiment of said quick change module **94** shown attached to the bottom of the forming tube **91**. The sectional view of **Figure 9b** is taken along reference lines **9b–9b** of **Figure 9a**. **Figure 9c** is a side view in elevation of the same quick change module embodiment.

With reference to **Figures 9a**, **9b**, and **9c**, it can be seen that the embodiment illustrated shows that the quick change module **94** comprises one pair of forming plates **104** and one tension bar **92**, which must perform the same functions as similar elements described above with relation to the vertical stand-up pouch. The module **94** is attached to the bottom of a forming tube **91**, as will be described below. The forming tube **91** illustrated in **Figures 9a** and **9b** is shown as a rectangular shape. Consequently, the module **94** is likewise rectangularly shaped. It should be understood, however, that the shape of the forming tube **91** and corresponding shape of the module **94** can be any number of shapes, such as a circle, an oval, a square, or other shapes.

The module **94**, for the embodiment shown, attaches to the bottom of the forming tube **91** by first inserting one or more tabs **96** that are integral to the forming tube into

corresponding holes **93** that are integral to the module **94**. The module **94** is thereafter secured by placing a tab **95** that is integral with a diverter plate **161** into a tab guide **97** that is integral with a diverter tongue **163**. As is evident from **Figure 9b**, this diverter tongue **163** rotates about a pin **168** that extends through a collar **166**. When the diverter tongue **163** is rotated in the direction of the arrow illustrated in **Figure 9b**, the tab guide **97** is lifted over the tab **95**. The tab guide **97** is biased in the opposite direction of the rotation indicated by the arrow in **Figure 9b** by a spring **170**. Pressure is maintained on the inside area of the forming tube **91** in the vicinity of the tabs **96** by virtue of one or more tongues **164** that fit on the inside opposite wall of the forming tube **91**. Consequently, once the module **94** is properly installed on the base of the forming plate **91**, the tabs **96** retain their position in their respective holes **93**. Likewise, the diverter plate tab **95** retains its position in the tab guide **97**.

As with the previous embodiments of the invention described above, the module embodiment illustrated also incorporates a diverter **161**. The diverter is used in combination with the diverter tongue **163** to keep product away from the vertical gusset areas. This diverter **161** can likewise be used as a gas flushing channel in addition to serving the purpose of keeping product away from the gussets formed by the forming plates **104**, as previously described above.

Also as with previous embodiments, the forming plates **104** can swing towards each other by rotating about a hinge **105**. This hinge **105** comprises a bolt **167** about which a shoulder **169** rotates. The shoulder **169** is in turn attached to the forming plates

104. This arrangement allows for the forming plates **104** to rotate about the bolts **167** and avoid ripping of the packaging film when the transverse seals are being formed below the forming plates by the transverse seal jaws (not shown).

While the embodiment illustrated in **Figure 9a**, **9b**, and **9c** is used for constructing vertical stand-up pouches, it should be understood that a second embodiment of the module **94** having the forming plates **104**, diverter **161**, diverter tongue **163**, and all accompanying components being duplicated on the side of the module **94** presently illustrated with the tension bar **92**, can be used to manufacture flat bottom bags. In other words, the flat bottom bag embodiment of the module can be easily understood by drawing a vertical line down the center of **Figure 9b**. All of the components on the right-hand side of such vertical line are then reproduced in mirror image on the left-hand side of the vertical line, thereby replacing the tension bar **92** elements with another pair of forming plates **104** and the diverter tongue **163,** *etc.*...

Another embodiment of the quick change module of the present invention comprises a module that can be installed on the bottom of a forming tube in order to quickly modify a vertical form, fill, and seal machine from the pillow pouch or the stand-up bag production to the production of stand-up packages having a zipper seal incorporated therein.

One embodiment of a vertical form, fill, and seal machine adapted for receiving this quick change module, as it relates particularly vertical stand-up pouches, is illustrated by **Figure 11**. The forming tube **191** illustrated in **Figures 11** is shown as having a

rectangular shape. Consequently, the module **194** is likewise rectangularly shaped. It should be understood, however, that the shape of the forming tube **191** and corresponding shape of the module **194** can be any number of shapes, such as a circle, an oval, a square, or other shapes. This forming tube **191** also includes a channel track **188** formed along one side for receiving a length of zipper seal mechanism **220** from a supply spool **218**. As previously shown in **Figure 10**, the length of zipper seal mechanism **220** is comprised of two interlocking zipper elements **222, 226**. Each of the zipper elements **222, 226** include a tab portion and an interlocking profile portion. For example, a first zipper element **222** includes a tab portion **223** and a male interlocking profile portion **224**; while the second zipper element **226** includes a tab portion **227** and a female interlocking profile portion **228**.

In accordance with the present invention, a length of zipper seal mechanism **220** is directed to the top portion of the forming tube **191** having a channel track **188** formed along one side such that the two interlocked profile portions **224, 228** of the zipper seal mechanism **220** are threaded down through the channel track **188**. The associated tab portions **223, 227** of zipper seal mechanism **220** are splayed out along the outer peripheral surface of the forming tube **191** by a roller mechanism **190** so as not to overlap one another.

In one embodiment, the channel track **188** comprises a deep groove fashioned into the outer peripheral surface of the forming tube **191**. Thus, as shown in **Figure 12a**, in cross section the channel track **188** is located on the interior of the forming tube **191**. In

an alternative embodiment shown in **Figure 12b**, the channel track **188A** is positioned on the exterior of the forming tube **191**. The channel track **188A** comprises a gap between two heat seal plates **246, 248** extending longitudinally along and attached to the outer peripheral surface of a side of the forming tube **191**.

The packaging film **120** (illustrated in phantom in **Figure 11**) is initially formed around the forming tube **191** in a conventional manner. However, prior to sealing the sheet of packaging film **120** with a vertical back seal **251** using a back heat seal bar **250**, at least a portion of each of the tab portions **223, 227** of the zipper seal mechanism **220** is sealed to the surface of the packaging film **120**. Thus, the tab portions **223, 227** are sealed to the inner layer **110** of the tube that is created subsequently by the vertical back seal **251**. As shown in **Figures 12a** and **12b**, the zipper heat seal bar **240** typically comprises multiple individual heating surfaces (*e.g.*, **242, 244**) for imparting a narrow heat seal on only a portion of each of the tab portions **223, 227** of the zipper seal mechanism **220**.

As shown in **Figure 11**, the zipper heat seal bar **240** is positioned above and approximately 90° out of phase from the back heat seal bar **250**. The tube is driven downward by an advancing mechanism (*e.g.*, friction against rotating belts **260, 262**). Thus, as the formed tube is advanced down the forming tube **191** in a conventional manner, the length of zipper mechanism **220** sealed on the interior of the formed tube is also advanced.

In accordance with one embodiment of the present invention, the zipper heat seal bar **240** and the back heat seal bar **250** each reciprocate concurrently with one another and

consecutively with the advancing means. That is to say, the advancing means advances a specific length of the tubular shaped material packaging film **120** and stops; whereupon, the zipper heat seal bar **240** and the back heat seal bar **250** each reciprocate into contact with the packaging film **120** imparting heat seals to the zipper seal mechanism **220** and vertical back seal **251**, respectively. However, as best illustrated in **Figure 11**, due to the configuration of the zipper heat seal bar **240** and the back heat seal bar **250**, at least a portion of the zipper seal mechanism **220** is always attached to the packaging film **120** prior to the imparting of the vertical back seal **251**.

The forming tube **191** is shown in elevation but would normally be integrally attached to the vertical form, fill, and seal machine. Also shown in **Figure 11** are a pair of prior art sealing jaws **108** likewise illustrated in elevation. Not shown in **Figure 11** is the sealing jaw carriage on which such sealing jaws **108** would be mounted below the forming tube **191**.

At the bottom of the forming tube **191**, a quick change module **194** is installed which quickly modifies the vertical form, fill, and seal machine from the pillow pouch or the stand-up bag production to the production of stand-up packages having a zipper seal incorporated therein. As will be subsequently explained in greater detail, the quick change module **194** incorporates two forming plates **204** and a tension insertion mechanism **202** as previously described for producing stand-up packages having a zipper seal incorporated therein.

Additionally, as with previous embodiments, the module **194** also incorporates

forming plates **204** that can swing towards each other by rotating about a hinge **205**. This hinge **205** comprises a bolt **267** about which a shoulder **269** rotates. The shoulder **269** is in turn attached to the forming plates **204**. This arrangement allows for the forming plates **204** to rotate about the bolts **267** and avoid ripping of the packaging film when the transverse seals are being formed below the forming plates by the transverse seal jaws **108** as shown in **Figure 11**.

Referring now to **Figures 11, 13c**, and **13d**, the module **194** also includes a tension insertion mechanism **202** comprising two projecting plates **192a, 192b** situated on opposing sides of a module channel track **189**. When the module **194** is attached to the bottom of the forming tube **191**, the module channel track **189** connects with and is co-aligned with the channel track **188** formed in the forming tube **191**. In accordance with the present invention, as the formed tube advances over the forming plates **204** and the tension insertion mechanism **202**, tension is applied such that the associated tab portions **223, 227** of the zipper seal mechanism **220** are projected away from the surface of the forming tube **191** and bent around the two projecting plates **192a, 192b** of the tension insertion mechanism **202** thereby blousing the packaging film **120** between the two portions of the associated tab portions **223, 227** sealed to the inner layer **110** of the formed tube. As particularly shown in **Figure 5d**, this blousing creates a headspace **201** between the film **120** and the interlocked profile portions **224, 228** of the zipper seal mechanism **220**. The creation of the headspace **201** improves the sealing qualities of the traverse seal subsequently applied to the package.

The embodiment of this quick change module **194**, as it relates particularly vertical stand-up pouches having a zipper seal incorporated therein, is illustrated by **Figures 13a, 13b, 13c** and **13d**. **Figure 13a** is a perspective view in elevation of the zipper seal insertion quick change module **194** suspended below the bottom of a forming tube **191** shown partially cut away in order to illustrate interior features. **Figure 13b** is a sectional view of the same embodiment of said quick change module **194** shown attached to the bottom of the forming tube **191**. The sectional view of **Figure 13b** is taken along reference lines **13b–13b** of **Figure 13a**. **Figure 13c** is a side view in elevation of the tension insertion mechanism **202** incorporated into the quick change module **194**. The sectional view of **Figure 13d** is taken along reference lines **13d–13d** of **Figure 13c**.

With reference to **Figures 11, 13a, 13b**, and **13c**, it can be seen that the embodiment illustrated shows that the quick change module **194** comprises one pair of forming plates **204** and a tension insertion mechanism **202**, which must perform the same functions as similar elements described previously with relation to the vertical stand-up pouch. The module **194** is attached to the bottom of a forming tube **191**, as will be described below.

The module **194** for the embodiment shown, attaches to the bottom of the forming tube **191** by first inserting one or more tabs **196** that are integral to the forming tube into corresponding holes **193** that are integral to the module **194**. The module **194** is thereafter secured by placing another tab **195** that is integral with a diverter plate **261** into a tab guide **197** that is integral with a diverter tongue **263**. As is evident from **Figure 13b**, this

diverter tongue **263** rotates about a pin **268** that extends through a collar **266**. When the diverter tongue **263** is rotated in the direction of the arrow illustrated in **Figure 13b,** the tab guide **197** slides along the tab **195**. The tab guide **197** is biased in the opposite direction of the rotation indicated by the arrow in **Figure 13b** by a spring **270**. Pressure is maintained on the inside area of the forming tube **191** in the vicinity of the tabs **196** by virtue of one or more tongues **264** that fit on the inside opposite wall of the forming tube **191**. Consequently, once the module **194** is properly installed on the base of the forming plate **191**, the tabs **196** retain their position in their respective holes **193**. Likewise, the diverter plate tab **195** retains its position in the tab guide **197**.

As with the previous embodiments of the invention described above, the module embodiment illustrated also incorporates a diverter **261**. The diverter is used in combination with the diverter tongue **263** o keep product away from the vertical gusset areas. This diverter **261** can likewise be used as a gas flushing channel in addition to serving the purpose of keeping product away from the gussets formed by the forming plates **204**, as previously described.

The vertical form, fill, and seal machine having the a quick change module **194** of the present invention shown in **Figure 11**, thereafter operates basically as previously described in the prior art, with the sealing jaws **108** forming a lower transverse seal, product being introduced through the forming tube **191** into the sealed tube of packaging film (which now has a crease on one side and a zipper seal on another side), and the upper transverse seal being formed, thereby completing the package.

The major differences between a prior art package and this embodiment of Applicants' package, however, are that a crease is formed on one side (which later becomes the bottom of the formed package) using the fixed mechanism described, a length zipper seal mechanism **220** in sealed onto the inner layer **110** of another side (which later becomes the top of the formed package) using the channel track **188** and fixed tension insertion mechanism **202** described, and that the graphics on the packaging film used by the invention are oriented such that when the formed package is stood onto the end with the crease, the graphics are readable by a consumer.

The quick change modules described herein, used in combination with the ability to move the tucker bar **106** away from the packaging film tube, as described with relation to **Figures 6a**, **6b**, **6c** and **11**, and the use of the tension screw **162**, allows for the conversion of a vertical form, fill, and seal machine from a standard pillow pouch configuration to a vertical stand-up pouch configuration (or flat bottom bag configuration), or to a configuration for producing stand-up packages having a zipper seal incorporated therein, and back again in a matter of minutes with several simple steps. Yet, the invention described does not require the addition of any parts that move during bag manufacture. Consequently, the invention is an improvement over the prior art in providing a simple, efficient, and effective modification to a vertical form, fill, and seal machine, that allows the operator to manufacture a standard pillow pouch bag, vertical stand-up pouch, flat bottom bag, or stand-up packages having a zipper seal incorporated therein with an easy change over and few collateral maintenance issues.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made and other adaptations and modifications can be employed therein without departing from the spirit and scope of the invention.